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On the Producing of Milk Having a Low Bacterial Content.*

WILFRID SADLER, C. D. KELLY and G. R. MARTIN

Department of Dairying, University of British Columbia, Vancouver, B.C.

INTRODUCTION.

During the past three decades considerable attention has been directed to the insuring of the production of milk having a low bacterial content. In more recent years there has been a pronounced tendency to attempt to concentrate on the more important of the many essentials which have proved to be factors exercising an influence on the ultimate bacterial quality of milk. It seems to us that the present position cannot be stated more succinctly than by citing from an address given at the recent National Milk Conference in England by F. Arnold Lejeune (1) —a milk-producing farmer. Lejeune observed "that the principle is recognized of grading the milk itself rather than the place from which it comes." It is not necessary for us to belabour the point emphasized by the speaker nor to elaborate upon the significance of his statement.

We must refrain from proceeding to discuss in detail the basic and informative literature to which we have had access during the years indicated above, for we desire to confine ourselves more particularly to the work which has dealt with the relation of average farm conditions to milk having a low bacterial count.

North (2) observes that "the factor which exceeds all others put together in importance is the dairyman himself;" and reports in detail the data which provides the foundation for his observations. Ayers, Cook and Clemmer (3) state that "the results of the experiments indicate that it is possible for the average dairyman on the average farm without expensive barns and equipment to produce milk (practically free from visible dirt) which when fresh has a low bacterial count. By the use of the three simple factors, namely, sterilized utensils, clean cows with clean udders, and teats, and the small top pail, it should be possible on the average farm to produce milk which corresponds closely to milk as it leaves the udder of the cow. A fourth factor of holding milk at as near 10°C as possible is also absolutely necessary." Delepine (4) emphasizes among other factors the very great importance of insisting upon cleanliness of cows, stables and personnel, the using of small top-pails and the effective sterilization of utensils. Stenhouse Williams and his co-workers have conducted investigations which indicate the more important factors governing the production of a pure milk, and their publications should be consulted (5). In one publication (6), it is concluded that: "The covered type of milking pail in the hands of a competent person is undoubtedly of considerable assistance in obtaining clean milk, but, unless it is cleaned and sterilized with scrupulous care its object is defeated..."..."the value of steam and the advantages accruing from its use for the proper sterilization of dairy utensils are established ..." ... "the experiments show that with intelligent and interested labour and with comparatively simple equipment, it is possible to produce milk of a high degree of purity in an ordinary cow-shed."

About a year ago, the specific opportunity which our own laboratories had been seeking, presented itself. We were brought into touch with a farm on the outskirts of Vancouver, engaged in the production of milk and the distributing of the same in the city. The proprietors of the farm, with, at that time, a herd of about twenty-five grade cows, were endeavouring to supply a high grade milk, a milk having a low bacterial content, and a milk secured from cattle giving a negative reaction to the tuberculin test. We approached the proprietors, Mr. and Mrs. Alexander Hill, and found that they were desirous of

*This investigation was made possible by the funds allocated under the Agricultural Instruction Act (1913).

co-operating with us. At the time, their milk was obtaining a premium over the usual price obtained for market milk sold in the city. We made it clear that we were anxious to secure data which would be of use to milk producing farmers generally with respect to the possibility of producing a high quality milk; and they, Mr. and Mrs. Hill, assured us that they desired to have advice and help if the same could be forthcoming. Finally we made the following arrangement: (a) we were to be permitted to obtain samples of milk at any time deemed most suitable to ourselves, (b) these samples were to be examined for bacterial flora to the end that we might secure the data we needed, (c) no report on the examinations was to be sent from our laboratories until it became possible for us to publish the data as a whole, (d) the proprietors of the dairy were to be given any information that was available from the laboratory data, but, under no circumstances, was the same to be used for publicity purposes, (e) we were to check up any of the procedures in vogue on the farm and dairy as far as proved to be possible without unduly interfering with the progress of our main project. The arrangement was agreed to mutually, and it is a matter of gratification to us that throughout the entire investigation the conditions detailed above were subscribed to loyally.

THE INVESTIGATION

We conducted preliminary work in February and March 1923, and the investigation proper commenced on April 10th, 1923, and continued until July 24th, 1923.*

We desire to make it quite clear that when we commenced work, we took conditions as we found them. The methods, practices and procedures in vogue were such as had been initiated by Mr. and Mrs. Hill, and we neither had nor have had any part or lot in prescribing the routine procedures of the day. As the work progressed, the proprietors themselves and of their own volition made one or two significant changes after having noted some of the data which was accumulating.

*NOTE—During the past summer, the senior worker was absent from the University, and the laboratory work was done by Mr. C. D. Kelly and Mr. G. R. Martin. Mr. Martin is conducting a detailed study of certain of the organisms isolated and retained during the work. W.S.

PREMISES

The farm and dairy were situated in an alder thicket at the bottom of a hollow. At the time of this investigation the cows were on pasture during the day, but were housed in the barn at night and fed there. The barn and milk house were frame buildings with heavy tar paper on the outside, and white washed on the inside. The floors, gutters, mangers and stanchions, were all of wood. Very little bedding was used.—See Figs. I and II. The barnyard was planked in its entirety on account of the low-lying situation of the premises. Viewed as a whole, the premises would be considered to be well below the average of what are usually considered as being suitable holdings for the production of milk.

Figure I.

General View of the Farm Premises.

Figure II.

Interior of the Cow Stable.

METHODS AND PROCEDURES

Just as our work was about to commence, a milking machine was installed; and throughout the investigation the machine was used, without interruption. At the time of milking, the udders of the cows were washed in clean, warm water, and dried with a cloth. Two cows were washed at one time, and fresh water was used for each two cows. It was a routine practice to draw the first milk—two or three "squirts" from each teat—into a pail through a cotton strainer; such milk being excluded from the regular supply, and used in feeding certain of the livestock. It is to be observed that a proceeding such as this has the additional advantage, in that abnormalities in milk are detected, and any undesirable milk is excluded from the general supply. As shown above, the milking-machine was used throughout, but the cows were stripped by hand, the strippings, of course, being mixed with the bulk milk. At once the milk was passed over an open cooler, the water for which was obtained from the city supply, and was strained through a cotton cloth into cans.—Figure III. After

Figure III.

Milk House, and Utensils after cleanzing and sterilization.

having been well mixed, the milk was filled into bottles by a hand operated bottling machine of simple construction. The cows were milked twice a day, and all the milk was delivered during the morning. It is obvious therefore that the morning's milk was two to three hours old at time of delivery and the night's milk fourteen to sixteen hours old at time of delivery. In a later part of this paper we shall show the prevailing temperatures to which the night's milk was exposed in the intervening 14 to 16 hours.

Cleansing and Sterilization of Utensils

The owners of the dairy proceeded on the assumption that cleanliness of utensils was a factor of paramount importance. Their system of cleansing and sterilizing was carefully followed. The cans and bottling-machine were rinsed with cold water, washed thoroughly in warm water containing washing soda and a small quantity of a prepared chloride of lime solution,* rinsed with cold water, and sterilized with live steam using a steam jet. The cooler was washed in the same manner, but was sterilized with boiling water instead of with live steam. The bottles were cleansed in a similar washing solution, using a mechanical brush, were rinsed in tepid water, and sterilized with live steam from steam jets. The milking machine was cleaned as follows: On the conclusion of milking operations, cold water was sucked through the machine; then it was taken apart, washed in the solution noted above, rinsed with clean water, and all parts other than the pails treated with boiling water for a few minutes. The pails were sterilized with live steam. We would draw especial attention to the fact that from April 10th to June 6th the procedure described immediately above was followed, except for the bottles, after the morning's milking only. After the evening's milking, the cans, bottling machine, cooler and milking machine were rinsed with cold water, and then with warm water containing a small percentage of the chloride of lime solution.* From June 6th to July 24th the procedure we have described was followed after both the morning and evening's milking.

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*NOTE. *Chloride of Lime Solution.* 12 ounces chloride of lime—available chlorine not less than 24 per cent.—and 24 ounces washing soda mixed in 720 ounces (18 quarts) of water: allowed to settle, the liquid being decanted off and retained in a covered glass vessel.

Samples and Sampling

At each sampling, two pint bottles of milk, intact, as bottled by the dairy, were taken by us on the premises. One bottle was of evening's milk—designated I in Table I, and one was of morning's milk—designated II in Table I. The bottles were chosen at random, and usually were obtained by us at 8.30 a.m. In addition, a sample of morning's milk after cooling and prior to bottling and representative of the entire supply, was taken—designated III in Table I.

Media Employed and Procedures

Bacto-Purple-Lactose-Agar (Dehydrated) (7) for the colony counts on plates.

MacConkey's Neutral-Red-Bile-Salt-Broth (8) for detecting lactose-fermenting (gas-producing) types of organisms.

All determinations were done in triplicate. Triplicate plates were incubated at 37°C. and at 22°C. respectively. The former were counted after 48 hours incubation, and the latter after 5 days incubation.

Fermentation Tests. Triplicate tubes, containing 20 cc of milk in each case, were submitted to the fermentation test at 37°C. and 22°C. respectively.

The Reductase Test. Triplicate tubes containing 20 cc of milk and .5 cc Methylene blue in each case were submitted to the Methylene Blue Reductase Test at a temperature of 37°C. The methylene blue solution was prepared as defined by Jensen (9).

Data Obtained

It has been stated previously that we conducted examinations from April 10th to July 24th, 1923, inclusive. We show also that when determinations were to be made, three samples were taken in every case. Throughout the entire period, samples were taken on thirty days; hence ninety samples in all were examined. From the detailed data on file in the laboratory, it may be seen that seven samples gave a count of 8150, 7800, 5050, 5260, 5800, 5800 and 5400, colonies per cc. respectively. Eighty-three samples gave a count of less than 5,000 colonies per cc.—using purple-lactose-agar incubated at 37°C. for 48 hours. A summary giving the averages of the counts for the period stated is presented in Table I, page 177. It will be seen that this table also includes the average number of hours required to reduce the methylene-blue, the average time occupied by the milk in clotting as defined by the Fermentation Test, and the average time in which the first signs of peptonization were observed, using the same test.

Reviewing Data Presented in the Table

It is seen that when average counts are presented, the highest average for any one period is 3680 colonies per cc: and that throughout the work, in all cases, for any period considered, the average count was below 5,000 colonies per cc. It is to be observed, further, that we failed to find organisms of the lactose fermenting (gas-producing) types in 1/10 cc. of the sample; from the detailed results of each individual sample on record in our laboratories, it might be seen that gas-producing types were absent from every sample of milk examined as determined for 1/10 cc. of the milk. Furthermore in only 5 samples of the 90 samples examined did we find the gas-producing types of organisms present in 1 cc. of the milk. The results indicate that the milks on which we were working were of excellent quality. Also, as far as the bacterial count is concerned, all the milks were well within the category "Certified Milk" (10), and well within the category defined in the recent English Regulations as "Grade A. Milk." (11).

It is worthy of note, that with the exception of the milks II, examined during the period June 6 to July 24th, all determinations showed a higher count on the agar media incubated at 22°C. (room temperature) than on the same media incubated at 37°C. (Blood heat.)

If we consider the counts obtained from I—bottle of evening's milk—we observe, that, the utensils being sterilized twice a day during the period June 6th to July 24th, notwithstanding, the counts are higher during this period than during the period April 10th to June 6th. It will be seen, however, on referring back to "cleansing and sterilization of utensils", that when the utensils were sterilized once a day only, the sterilizing was

TABLE I.

Total Number of Samples 90. Milk Produced by the Milking Machine.

Samples	Dates of Sampling 1923	No. of Samples examined	Treatment of Utensils	Plate Counts: No. of colonies per c.c. Average for No. of Samples specified in Column 3. Incubated at 37°C.	Plate Counts: Incubated at 22°C.	Presumptive test Gas-producing types in 1/10 cc. Milk.	Reductase Test Hrs. required to reduce Meth. Blue 37°C.	Fermentation Test: No. of hours Before Milk clotted 37°C.	Before Milk clotted 22°C.	Before peptonization observed. 37°C.	Before peptonization observed. 22°C.
I. Bottle of Evening's Milk.	April 11 to June 6.	14	Utensils sterilized once a day.	2000	2130	0	23	43	86	27	59
	June 6 to July 24.	16	Utensils* sterilized twice a day.	3040	3460	0	24	35	101	23	61
II. Bottle of Morning's Milk.	April 11 to June 6	14	Utensils sterilized once a day.	2920	3650	0	24	43	101	24	63
	June 6 to July 24.	16	Utensils sterilized twice a day.	2740	2660	0	23	38	105	22	62
III. Sample Morning's Milk.	April 11 to June 6	14	Utensils sterilized once a day.	3120	3680	0	23	42	104	25	63
	June 6 to July 24.	16	Utensils sterilized twice a day.	2470	2660	0	23	37	101	22	61

*See special note page 176.

done after the morning's milking. Hence, the milk represented under I, during the entire period from April 10th to July 24th, was all produced with the aid of sterilized utensils. This milk, after bottling, remained in the milk room of the farm from about 6 p.m. on the day of milking to 8.30 a.m. the following morning. The prevailing temperature, therefore, between the hours of 6 p.m. to 8.30 a.m. is a factor which may have had an effect on the total bacterial count. We are greatly indebted to Mr. T. S. H. Shearman, Director of the Vancouver Laboratory of the Dominion Meteorological Service, who most courteously made it possible for us to secure a copy of his records of temperatures for the periods during which we were engaged upon the work; and, for the hours—6 p.m. to 8 a.m.—through which the evening's milk was held in the farm milk room. We

find from Mr. Shearman's records, that on the dates when samples were taken during the period April 10th to June 6th, the average maximum temperature prevailing for the hours 6 p.m. to 8 a.m. was 60°; the average minimum temperature was 47.5° and the average mean temperature was 52.5°. On the other hand, the comparative figures for the period June 6th to July 24th were 65.6°, 52.9° and 57.5° respectively. We do not say that the prevailing temperature has been responsible for the difference in counts, but we present the situation as it stands, for consideration.

In contemplating the counts reported under II and III, it will be seen, that, throughout, these samples were of morning's milk; and it is to be observed that the samples were examined in our laboratories within two to three hours from the time of milking. In the case of the II series and the III series respectively, the counts were higher during the period April 10th to June 6th than during the period June 6th to July 24th. The short time elapsing between milking and our examinations practically eliminated any possible influence of temperature during the entire period. But, it will be noted that in each case, the morning's milk during the period April 10th to June 6th was secured by the use of utensils which had been cleaned but not sterilized after the previous milking. From June 6th to July 24th the utensils were sterilized after the evening's milking as well as after the morning's milking. Hence it would seem that the sterilization of utensils exercised a quite definite influence on the bacterial content of the milk reported under II and III during the period June 6th to July 24th.

The Reductase Test

In consulting the table, it will be seen that little variation is evident in the number of hours required for the milk samples to reduce the methylene blue. From our laboratory data we find that no reduction had taken place in any sample after eight hours' incubation. A very practical difficulty with respect to recording the exact time in every case presented itself; for very often, the change would take place during the night when the laboratory was not under observation. It should be noted, however, that judged by this test all the milk would be classed as of excellent quality according to the system of grading recommended by Barthel & Jensen (9). For they, the workers who devised the test, conclude that all milks which fail to reduce the methylene blue within five and a half hours are milks of good quality bacteriologically—provided that the fermentation test fails to show the presence of undesirable types and strains of bacteria. Hence, the results from the Reductase Test, are, in the main, entirely in conformity with the plate counts inasmuch as the indications are that we were working on milk having a low bacterial content.

The Fermentation Tests

The average of the number of hours elapsing before clotting took place as shown on the table indicate, again, that we had milk having 'a long period of usability', milk of high quality. We would draw particular attention to the results of the fermentation tests determined at 22°C. (room temperature). Furthermore, the periods which elapsed before any peptonization of the milk could be observed are significant; and the results of the fermentation tests as a whole are indicative of milk having a low bacterial content. As mentioned above, in discussing the Reductase Test, the exact time the reaction took place could not be noted at all times, as the critical changes might have taken place during the night.

THE RESULTS AS A WHOLE

Taking the results of the plate counts, the Reductase Test, the Fermentation Test, and the Presumptive Test for the gas-producing types as a whole, we are led to observe that the samples of milk examined represented milk of excellent quality bacteriologically.

OBSERVATIONS

This paper reports an investigation into the bacterial quality of the milk produced on a farm in the vicinity of the City of Vancouver. The proprietors of the farm function as producers and distributors and the milk is on sale in Vancouver. The arrangements pertaining to the collaboration of the proprietors with us in our endeavour to se-

cure data are detailed in preceding pages. It is stated that the farm premises would be considered to be well below the average of what are usually considered as being suitable holdings for the production of milk. It is to be observed that when we commenced work we took conditions as we found them.

A milking machine was used throughout. The methods and procedures adopted by the proprietors of the farm dairy are detailed in preceding pages. In particular, attention is directed to the system followed by them in the cleaning and sterilizing of the utensils.

Our investigation was pursued for a period extending from April 10th, 1923, to July, 24th, 1923. Ninety samples of milk were secured by us, and the bacterial content of the same determined. It is reported elsewhere that 83 of the 90 samples gave a count of less than 5,000 colonies per cc. using purple-lactose-agar incubated at 37°C. for 48 hours. In table I we give a summary of the averages of the plate counts; the results of the presumptive test for gas-producing types; and the results obtained when the milk was submitted to the Fermentation Test; and to the Reductase Test respectively. With regard to the bacterial counts—the number of colonies per cc. as shown by the plate method—it is to be seen, by perusing the table, that the averages for the periods as specified vary from 2,000 colonies per cc. to 3120 colonies per cc. It will be observed that no gas-producing types were found in 1/10 cc of the milk. In a discussion on the table, it is observed by us that the results, as a whole, considering the data available for all our determinations, indicate that the milk produced on the farm under consideration is of excellent quality bacteriologically.

It is to be noted that the milk which has been proved by us to be of high quality has been produced on a farm having poor premises; and we would emphasize the fact, that, in spite of the disabilities attendant upon such premises, the proprietors have succeeded in attaining their objective to a marked degree.

The effect of sterilization of utensils is to be seen by consulting the table.

It is our conviction, based on the work recorded herein, that the results are indicative of the paramount importance which is to be attached to the quality of the personnel, as factors influencing the bacterial quality of milk. It remains to be said, that the milk produced and distributed by the farm dairy under consideration commands an enhanced price in the City of Vancouver.

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Lime Sulphur Injury.

J. S. SHOEMAKER

University of Minnesota, St. Paul, Minn.

It is not definitely known how lime sulphur causes injury when sprayed on plants. At times in the orchard the application of the solution results in an increased amount and severity of injury under certain conditions. Various factors intimately related to the lime sulphur type of injury may be summarized under the following theories: (a)—the soluble polysulphides as the direct active agents; (b)—absorption of the lime sulphur by the chlorophyll; (c)—sunlight; (d)—heat; (e)—gas; (f)—acid; (g)—oxidation; (h)—minuteness of sulphur particles.

While the soluble polysulphides through decomposition and other chemical and physical changes may cause spray injury when lime sulphur is sprayed on plants, the fact that similar damage may occur when the soluble polysulphides are not active factors, and when the injured part is not in direct contact with the spray material is sufficient to make each theory at times independent.

Studies with spray materials in so far as the control of insect pests is concerned rightfully belong to the field of the economic entomologist; with fungous diseases, to the plant pathologist; with ingredients and manufacture, to the chemist; but this article is more or less limited in scope to a survey of the literature dealing with a few theories leaning towards physiological horticulture.

Experience and observation in past years have indicated that some of the factors conducive to, and correlated with the lime sulphur solution destruction of chlorophyll are conditions leading to a thin epidermis, reduction of pubescence, loose internal structure, presence of nascent oxygen, strong sunlight liberating actinic rays and heat, and subsequent killing and oxidation of the tissues.

A microscopical examination of apple leaves injured by lime sulphur shows that the affectation first appears on the underside of the leaf as a slight russetting. The injurious substance evidently enters through the stomata as the browning begins at these openings. Within 24 hours the brown coloration works through the leaf to the upper surface.

Soluble Polysulphides

That the soluble calcium polysulphides in the lime sulphur solution may be the cause of the injury is shown by Wallace (16), Safro (13), and Maney and Beach (8). It may be mentioned that this injury is the one most commonly advanced to account for injury from lime sulphur solution. When the spray solution has dried on the foliage, which under conditions of low humidity and sunshine may occur in ten minutes time, the substances causing injury are said to be decomposition or oxidation products of the soluble polysulphides.

Absorption of the Lime Sulphur by the Chlorophyll

Under certain conditions of sunlight Sanders (14) finds by sectioning leaves injured by lime sulphur, and putting them under the microscope that the lime sulphur is absorbed by the leaves, causing a marked change and browning of the chlorophyll in the palisade tissues.

Sunlight

The ultra-violet rays, as well as the lime sulphur, may also be absorbed by the chlorophyll in the leaves and cause injury, as is pointed out by Palladin and Ginbennett (12). But there is a difference in the extent to which different types of leaves will absorb the actinic rays. In this connection Dangeard (4) mentions that hairy leaves retard penetration of the violet and ultra-violet rays through the tissues more than glaucous or smooth ones.

The thickness of the epidermis is also of interest in relation to spray injury under the influence of the actinic rays of the sun. Maquenne and Demoussy (9) call attention to the fact that leaves are often blackened under the influence of the electric light.

When leaves with a thin epidermis are exposed by them to the action of a mercury lamp, the light of which is very rich in ultra-violet rays, the leaves are blackened within two to three hours, while if the epidermis is rather thick it requires ten to twelve hours to produce such an effect. Their work indicates that the action of the ultra-violet rays results in the destruction of the protoplasm of the cells of the plants. The experiments lead them to the belief that the action is a diastatic one and is generally due to the effect produced on the oxidase following the destruction of the protoplasm.

Now it may seem a paradox that by sunlight there shall be injury caused to the green coloring matter of the leaves. We expect in sunlight to have a building up of tissue and organic material due to photosynthesis. In this case, the efficient rays of the spectrum are exerting more influence than the injurious rays, the action of the latter being negligible.

In this connection Wiesner (17) may be quoted as follows: "Light not only aids in the development of chlorophyll but at higher intensities brings about its destruction probably through oxidation. The decomposition of chlorophyll occurs outside the plant as well as within its tissues. This can be demonstrated by exposing a test tube containing a solution of chlorophyll to the light and comparing it with others kept in darkness. Red and yellow light are most effective in destroying chlorophyll."

Two primary factors of interest here are given by Garner and Allard (5) as entering into the action of light upon plants, viz., (a)—the intensity of light, and (b)—the wave length. As regards intensity they state: "Within limits, reduction in light intensity tends to lengthen the main axis and branches and to increase the superficial area of the foliage of many species. Also, the thickness of the leaf lamina may be reduced, and there may be marked departures from the normal in internal structure, the tendency being toward a less compact structure." In its relation to spray injury this statement is of particular interest especially if such conditions are present at a time when there is a depletion of the chlorophyll content of the leaves as Sanders in his studies on the effect of light on the chlorophyll content mentions that plants kept for a period in darkness and then exposed to sunlight show a burned appearance more readily than those kept in full sunlight. The explanation offered by him is that chlorophyll is not manufactured in the absence of sunlight, and the depletion of chlorophyll following a period of darkness results in more serious injury when the leaves are again exposed to sunlight.

This viewpoint is strengthened by the investigations of Bonnier (2) who using one-third the intensity of sunlight by employing electric light, observes a lessening in amount of chlorophyll formed even to unusual depths.

Hence when we have such conditions bringing about a depletion of the chlorophyll content of the leaves, the foliage becomes more susceptible to spray injury on exposure to sunlight. Darkness is thus one of the factors influencing this phenomenon.

In connection with the factors mentioned previously, (thickness of epidermis, pubescence, and looseness of internal structure), the work of Gourley and Nightingale (6) is of some value in showing the effects of shade on plants. In their work on the effect of shade on foliage and structure of leaves they state: "Not only was the area of the leaf surface affected to a marked degree by the shading, but the contour of the surface was also strikingly changed. "The structure of the apple leaf is usually characterized by at least two layers of palisade cells, and often by a third one; the mesophyll is rather dense and the epidermis is relatively thick. In contrast to this condition the shaded leaves possessed but one layer of palisade cells (occasionally a second layer of shorter cells), the mesophyll was loose in structure, and the epidermis was thinner than that of those grown in direct sunlight. The "sun" leaves were on the average 90 percent. thicker than those grown in the shade."

It is well known that when lime sulphur is sprayed on the fruit of the apple on hot, sunshiny days injury is liable to occur. Caesar (3) is of the opinion that sun-scalding of certain varieties after spraying with lime sulphur on a hot, calm, sunny day on the sun exposed parts will show the injury after the fruit has got to be one-half inch, and up to two inches in diameter. Shaded fruits

are not at all affected even on the same tree. Safro (13) states that: "Cases reported as lime sulphur injury are frequently due to other causes, often sunburn." Continuing he says: "The lime sulphur as used was non-injurious under ordinary circumstances but that under the direct rays of the sun during the hottest part of the day the spray upon the trees was rendered injurious."

In propounding his theory on the dropping of apples sprayed with lime sulphur Sanders (14) writes as follows: "From such information as could be gathered from other sections, and from varying experiences in different seasons, it was found that the intensity of the injury seemed to vary with the amount of sunlight during May, June, and July. In England, New Zealand, and Kootenay Valleys in British Columbia and in Nova Scotia fruit removal by lime sulphur seems to occur every year,—In areas such as Ontario, New York State, New England, etc., where there is more sunlight, say an average of over 250 hours of sunshine per month during May, June and July, it would seem that serious fruit removal by lime sulphur only occurs in seasons when the amount of sunshine per month falls below that figure. Since chlorophyll depends on sunlight, not only for its action in converting carbon dioxide into sugar but for its own actual formation, it can readily be seen that in years of plenty of sunlight the chlorophyll would be replaced almost as fast as it was injured and the injurious effects on the crops and tree rendered almost negligible. Whereas, in years of little sunlight the injury might be severe in the same areas."

Heat

It is shown by Maney and Beach (8) that the presence of the actinic rays of the sun and a temperature of 102°F are necessary for spray injury to foliage from lime sulphur solution. They also find that when the actinic rays are not exerting an influence a higher temperature is necessary before injury to the leaves will result, and obtain this effect in the absence of the sun's rays by placing leaf-bearing twigs of apple covered with a film of spray solution in the electric oven at a temperature of 108°F.

From his experience with dusting materials Sanders (15) states: "It must be remembered that the copper dust is a better fungicide than sulphur and that there is danger of any sulphur compound burning the fruit and foliage if the temperature remains above 90°F for any considerable period following its application."

The opinion of Barss (1) indicates the need for definite information on heat as a factor in lime sulphur spray injury. He writes as follows: "Temperature has an important effect on the activity of sulphur sprays. In hot weather, weaker dilutions of lime sulphur should be used. No accurate experiments have yet been conducted to determine the exact relations of temperature to sulphur sprays, but the Crop Protection Institute is, I understand, about to undertake such studies the coming season. These could give us some valuable information which has long been needed."

The observations of Barss also indicate that the so-called "sulphur-shock", which occurs when for some reason the earlier applications have been omitted, is likely to be influenced and brought about by a high temperature, or at least during the season of the year when high temperatures are usually prevalent.

Gas, Acid, and Oxidation

The theories concerned with gases, acids, and oxidation are closely related. In this connection the general supposition would be for a gas to be set free from the lime sulphur solution. The gas then would undergo a change resulting in the formation of an acid. This might occur on the external surface of the leaf or fruit, or in the internal tissues. It might be that from lime sulphur the acid would be sulphurous, or sulphuric. The brown coloration of the injured part would be the outcome of oxidation.

Observations of the action of sulphur powder in the greenhouse led to the belief that when sulphur is left on the pipes heat and sunlight under certain conditions liberate an appreciable amount of gas. In support of this view Norton and White (11) point out that vaporizing sulphur without ignition, as by painting it on the heating pipes or warming it over lamps, is usually effective in controlling the mildew of roses.

Lime sulphur has its characteristic odor, thought to be due to the presence of gases such as, hydrogen sulphide and sulphur dioxide. Possibly these gases H_2S and SO_2 may unite with oxygen (O) and Hydrogen (H) respectively to form sulphurous (H_2SO_3), or sulphuric (H_2SO_4) acids. It is realized that these changes would take place in the orchard only under very unusual conditions. But undoubtedly some acid is formed or liberated, at times, which is not present in original form in the lime sulphur before application of the solution to the tree. If conditions are favorable for its formation soon after spraying the injury may occur immediately, or some time may elapse before environmental influences cause the damaging substances to do their work.

It is well known that pure sublimed sulphur contains small amounts of sulphuric acid. When sulphur is gently heated over steam pipes Kraemer (7) shows that it gives off sulphuric acid. Pure sublimed sulphur is found by Marcille (10) to contain from 0.20–0.625 percent anhydrous sulphuric acid.

Maney (8) after spraying apples with sulphuric acid 1-1000, obtains injury similar to sun-scalding from lime sulphur by exposing the apples on a window sill to the direct rays of the sun.

Minuteness of Sulphur Particles

Lime sulphur contains some very fine sulphur particles—minute ones in fact. It is believed that these very small particles are concerned in lime sulphur injury. Sometimes their behaviour in some respects is comparable to that of a gas, (due to their lightness), at others they exert an acid effect, and again their fine state is an aid to volatilization and oxidation. Certain environmental conditions surely break up some of the sulphur to minute particles, and other factors also enter into the problem. Fine pulverization is one of the points often emphasized in bringing out the superiority of certain spray products over others. The insecticidal and fungicidal properties are said to be increased. Probably they are, and this certainly is the purpose for which sprays and dusts are applied. On the other hand relatively large parts of injurious substances must be avoided. Increased efficiency with spray materials has led to many experiments to find a solution or dust which will give equally satisfactory results under one and all conditions. Just a few years ago, and also at the present time, considerable attention has been given to securing more spread in spray solutions. Some good results have been claimed, failures are on record, and frequently no appreciable effect either way has been noticed. Where a spreader is added there may be the possibility of the change in the surface tension affording a means of more of the injurious substances entering the stomata. The lowering of the surface tension and the increased area covered with the thin film are two of the factors concerned.

The material within the cells, and in the intercellular spaces may be said to be at a relative state of equilibrium and whenever environmental factors or spray applications disturb this balance, changes leading to injury may be expected. The cause of lime sulphur injury is external to the plant, but the effect is internal. At times, the various factors mentioned may act independently, at others they may act in conjunction, or as supplemental to one another. That is, we are not yet in a position to select any one factor and say that such a one is the cause of lime sulphur injury under one and all conditions. Physiological considerations are well worthy of attention particularly when entomological and pathological aspects are placed in the background for the time being, and the problem regarded from the vegetative standpoint.

In any event injury is to be regarded as a minor matter, and the benefits to be derived from thorough and timely spraying or dusting are always to be emphasized in orchard work.

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Identification of Varieties of Fruit Trees from Leaf and Other Growth Characters.

W. H. UPSHALL

Horticultural Experiment Station, Vineland, Ont.

A preliminary paper on this subject entitled "Certification of Nursery Stock" was read before the 1922 Annual Convention of the Ontario Fruit Growers' Association. In that paper the question of nursery stock untrue to name was discussed, and certain proposals for certifying stock true to name were put forward. It was shown that, as a result of investigational work done in Massachusetts, the leading varieties of apples could be readily and positively identified in the nursery row, namely by variation in leaf characters.

It was pointed out, however, that no study had been made of other fruits—that no means of positively identifying non-bearing trees of peaches, pears, plums and cherries existed. The suggestion was made that the Horticultural Experiment Station might undertake the necessary investigational work with a view to finding if a similar means of identification were not possible. The writer was appointed to carry on this work the past year. A brief outline of the work accomplished and the conclusions reached are here given.

Detecting mixtures in young apple trees in the nursery row is not at all a difficult problem. In fact it is quite as easy as Dr. Shaw of Massachusetts has intimated, and moreover, a careful inspector should make absolutely no mistakes. The report of an inspection of a block of two-year old apple trees in a large Ontario nursery undertaken this past summer was completely confirmed by experienced nurserymen when their attention was drawn to the mixtures in the nursery row. The point is that there are so very many growth characters which may indicate a mixture that, with few exceptions, trees untrue to name can be spotted without any hesitation and often from a considerable distance. To give an illustration, Rhode Island Greening, a spreading, ragged grower could be detected ten rods away in a row of Ontario, which has a neat, upright habit of growth. Leaf and other characters confirmed this more apparent difference.

With the other tree fruits the problem has been entirely one of becoming acquainted with the appearance of the leaves of the various varieties and their growth habits. With this in mind, collections of normal and typical leaves of varieties of peaches, pears, plums and cherries have been made. After photographs were taken the leaves were pressed until dry and then placed in Riker mounts beside typical shoots of the same variety. This collection includes—varieties of pears, twenty; peaches, twenty-three; cherries, thirty; and plums, twenty-seven—just one hundred varieties in all. Here are assembled all the commercial varieties which

one could be justified in recommending for Southern Ontario and many which, though now grown, should perhaps not be recommended further. A list of these varieties appears on a separate page. Beside this, the leaves of all of these, except sweet cherries, have been preserved in formalin solution to keep them in a natural state for winter study.

Just enough work has been done to prove beyond doubt the possibility of identifying varieties of tree fruits before the tree begins to bear. Time has not permitted a very detailed study of varieties and it is quite certain that further work will indicate other outstanding differences. Special attention has been centred on peaches, and to give an idea of the means of recognition, varieties will be classified and four common varieties fully compared in the course of this outline.

It has been found that the leaves of any one variety vary considerably at different points on the tree. The nursery is the place where the most uniform conditions prevail and consequently it is without a doubt the best place for study. However, it can plainly be seen that correctly named variety orchards must be used as a check on the nursery work. The leaves found about half way along the current season's growth are the most reliable for study, and leaves, most constant in characters and varying least with conditions, are those on young trees in the nursery and on water shoots or long terminal growths on older trees.

Peach varieties can be classified according to color of fruit flesh and type of foliar or leaf glands which appear at the base of the blade of the leaf. Color of fruit flesh is indicated in the leaves by the presence or absence of yellow coloring (pigment). This can only be determined by looking at a leaf against the sun's rays. Yellow-fleshed varieties show this yellow color plainly, while in white-fleshed peaches it is almost entirely lacking. Then there are two distinct types of leaf glands, namely, reniform or kidney-shaped and globose or round. Following is the classification of peach varieties according to these characters:

A. Absence of yellow pigment in leaves (white-fleshed).
  1. Globose glands.
    (1) Mountain Rose.
  2. Reniform glands.
    (1) Belle
    (2) Carman
    (3) Greensboro
    (4) Leamington

B. Presence of yellow pigment in leaves (yellow-fleshed).
  1. Globose glands.
    (1) Brigdon
    (2) Early Crawford
    (3) Fitzgerald
    (4) New Prolific
    (5) Niagara
    (6) Reeves Favorite
    (7) St. John
  2. Reniform glands.
    (1) Admiral Dewey
    (2) Arp Beauty
    (3) Beer's Smock
    (4) Cline Seedling
    (5) Elberta
    (6) J. H. Hale
    (7) Lemon Free
    (8) Lincoln
    (9) Rochester
    (10) Smock
    (11) Yellow Swan

It can readily be seen that this classification alone will be of great benefit in simplifying the identification of peach varieties. There are four groups, and when a variety of one group becomes mixed with a variety of another group the mixture should be easily detected. For distinguishing varieties within a group other characters must be taken into consideration.

Peach varieties show a wide variation in the way they are affected by the autumn frosts. Some take on reddish colors, others remain quite green; some drop their leaves early and others have very persistent leaves. Because of these facts there is a possibility that the fall of the year may prove to be the best time to do certification work with peaches. The differences are not so apparent during the growing season when all varieties are a vigorous green. As an illustration, observation in a certain nursery in the fall of the year indicated several trees of New Prolific in an Elberta block. The latter variety had dropped all its leaves and the former, being yet in almost full foliage, was easily distinguished.

ST. JOHN.

FITZGERALD.

In order to indicate the various points of contrast two varieties in each of two groups will be compared. The accompanying photographs illustrate the differences.

1. ST. JOHN—FITZGERALD.

(1) The mid rib of the Fitzgerald leaf is much more reflexed than that of St. John, and especially near the tip.

(2) Fitzgerald leaf is crinkled at the base and along the midrib while St. John leaf is smooth.

(3) The serrations on the margin of the Fitzgerald leaves are a little sharper and deeper.

DIFFERENCES NOT TO BE SEEN IN THE PHOTOGRAPHS

(4) In the nursery row Fitzgerald is a more vigorous grower, and its leaves, especially at the tip of the new growth, are lighter in color.

(5) Color of the young shoot of Fitzgerald is a much deeper red.

(6) The leaves of Fitzgerald become more colored in the fall of the year and drop a few days before those of St. John.

2. ELBERTA—ROCHESTER.

(1) Elberta leaves are about twice as large—longer and broader. They are thicker, rather leathery in texture, with much larger but usually less numerous glands and coarser, deeper serrations. The Elberta leaf is only slightly folded whereas the Rochester leaf is distinctly folded, waved and crinkled and has a finer petiole.

DIFFERENCES NOT TO BE SEEN IN THE PHOTOGRAPHS

(2) Rochester shoots are dark red; Elberta shoots pinkish.

(3) Rochester leaves turn quite reddish in the fall and hang on fairly well; Elberta leaves do not change color appreciably and fall early, excepting two or three of the youngest leaves on the end of each shoot, which are more persistent.

ELBERTA.

ROCHESTER.

It should be pointed out that the study of photographs, mounts and descriptions of leaves will certainly not enable one to become an expert in identifying varieties by their leaves. The practical study of the trees as they grow is absolutely essential. However, photographs, mounts and descriptions are of advantage in the study in that certain varieties or all of them can be brought before the eye at one time.

Not so much study has been done with pears, plums and cherries. It is almost certain that pears will present little difficulty, for even in their dormant condition, they are more easily distinguished than apple varieties. Moreover, the leaves and habits of growth are quite typical of varieties. Owing to a limited number of varieties sour cherries offer little excuse for mistaken identity. Early Richmond, a spreading grower, can easily be distinguished from Montmorency, a vigorous, upright grower. The number of glands, their shape and position, the size and shape of the buds and the general shape and serrations of the leaves themselves will form the basis for the identification of varieties of sweet cherries. Not enough work has been done with plum leaves to make any recommendations but distinct varietal differences can readily be noted.

The loss incurred from nursery stock coming untrue to name is an old story to fruit growers. However, it might be well to give a few instances in this connection. One grower purchased over a period of three years what were supposed to be 1,100 St. John peach trees, and when they had all borne fruit he found that only six trees were St. John, the remainder being a mixture of varieties ,some commercial and some not. Inspection of a block of Elbertas this summer revealed only 77% Elberta, the remaining 23% being Smock and St. John—out of 189 trees, 27 were Smock and 17 St. John. This was a young orchard in which some of the trees had not yet begun to bear. However, positive identification from leaf and other growth characters was possible. Another grower ordered 49 trees of four varieties of peaches at the same time and from

the same nursery. Here is the result: Belle (15 trees) are Early Crawford; Yellow Swan (9 trees) are Admiral Dewey; Early Crawford (10 trees) are St. John; Greensboro (15 trees) are true to name. Only a few of these trees were in bearing, but again identification by leaf characters was certain. A few years ago one nursery sent out a number of Spy trees which proved to be about 50% Ontarios. Because young trees of Spy and Ontario have a somewhat similar habit of growth it would appear as if the trouble in this case might have arisen through carelessness in cutting bud wood. At least one of the fruit growers complained to the nursery about this stock. The result was that the nursery firm sent a man to look over the young orchard. He saw a number of Ontarios bearing fruit, and drawing a hasty conclusion, advised his company to settle up for the whole lot, which they did. The grower was indeed well pleased a few years later to find that about half of his trees were Spies. This was a case where a nursery firm lost out because their representative could not distinguish these varieties. A study of leaf characters would have prevented the mistake and, in this instance, saved money for the nursery.

These instances are cited merely to draw attention to the losses incurred through incorrectly named nursery stock, and incidentally to point out the probability that such losses may eventually be largely prevented by inspection and some form of certification of nursery stock. At least one further season's study, probably two seasons, will be necessary to complete the investigational work under way.

VARIETIES OF FRUITS UNDER STUDY

Plums

1. Abundance
2. Arch Duke
3. Bradshaw
4. Burbank
5. Diamond
6. Duane's Purple
7. Fellenburg
8. Field
9. General Hand
10. German Prune
11. Glass
12. Golden Drop
13. Grand Duke
14. Gueii
15. Imperial Gage
16. Lombard
17. Monarch
18. Peter's
19. Pond
20. Quackenboss
21. Red June
22. Reine Claude
23. Shippers' Pride
24. Shiro
25. Shropshire Damson
26. Washington
27. Yellow Egg

Cherries

A. Dukes.

1. Late Duke
2. May Duke
3. Royal Duke

B. Sweets.

1. Black Eagle
2. Black Tartarian
3. Bing
4. Deacon
5. Early Lyons
6. Elton
7. Governor Wood
8. Lambert
9. Napoleon
10. Pickering
11. Republican
12. Rockport
13. Windsor Seedling
14. Schmidt
15. Windsor
16. Yellow Spanish

C. Sours.

1. Baldwin
2. English Morello
3. Early Richmond
4. Dyehouse
5. Montmorency
6. Olivet
7. Ontario Preserving
8. Ostheim.
9. Timmie
10. Vladimir
11. Wragg

Peaches

1. Admiral Dewey
2. Arp Beauty
3. Beer's Smock
4. Belle.
5. Brigdon (or Garfield)
6. Carman
7. Cline Seedling
8. Early Crawford
9. Elberta
10. Fitzgerald
11. Greensboro
12. J. H. Hale
13. Leamington
14. Lemon Free
15. Lincoln
16. Mountain Rose
17. New Prolific
18. Niagara
19. Reeve's Favorite
20. Rochester
21. St. John
23. Yellow Swan

Pears

1. Anjou
2. Bartlett
3. Beurre Hardy
4. Bosc
5. Boussock
6. Clairgeau
7. Clapp's Favorite
8. Dempsey
9. Duchess
10. Easter Beurre
11. Flemish Beauty
12. Giffard
13. Howell
14. Kieffer
15. Lawrence
16. Louise
17. Ritson
18. Seckel
19. Sheldon
20. Winter Nelis

Alberta Crop Improvement Association.*

G. H. CUTLER

Professor of Field Husbandry, University of Alberta, Edmonton.

In describing the work of the Alberta Crop Improvement Association it will be necessary for me to go back a few years and tell you something of its origin and development, because this organization has grown up as a part of the Department over which it is my privilege to preside. Its organization is an outgrowth of existing conditions and can be justified only on those grounds.

In coming to Edmonton in June 1917 steps were at once taken to study the status, problems and methods of crops and crop production in the province of Alberta. Government records and reports revealed that crops assumed an important place in the commercial and industrial life of the province. It seemed that the ranch had pretty well passed, to be supplanted by the dry-land grain farm, irrigation farm, dairy farm, beef, hog and poultry farm. The growing of farm crops, therefore, as a primary and secondary farm product had clearly become an enterprise of first importance, and it was quite evident that the successful development of agriculture in the province rested very largely upon success in crops and crop production.

This being true, more exhaustive studies were made of climatic and topographic conditions in so far as it was possible from available data. These researches revealed wide variations in natural vegetation, altitude, precipitation, temperatures, evaporation, atmospheric humidity, wind, and as well soil conditions. In fact so variable did these features appear that it seemed no two districts enjoyed, in the same degree, the same conditions of topography, soil or climate.

* Address given before Members of the Alberta Branch C.S.T.A., Calgary, Nov. 8, 1923.

This became the more interesting and difficult because of the extremes that prevailed.

In some sections moisture appeared to be one of the main limiting factors in production; in others low temperatures, and likelihood of June or August frosts; and in still others a combination of low precipitation, high evaporation, and hot winds at certain critical periods of the growing season, prevailed. These are some of the main points that were revealed, which pointed quite conclusively to the need—with such a wide range of conditions in the province—of a very carefully planned program of experiments and investigations, in order that crops might be grown in a profitable manner. It became quite evident that the experimental and research work undertaken in the Department of Field Husbandry, must centre around such factors as drought, low temperatures, high evaporation, and short growing season. In short the plant or crop and its environment must be given the dominant position in our program. Accordingly development in the Department of Field Husbandry has since been directed along three main avenues, as follows:

(1) A study of the climate of Alberta and its reactions upon crops.

(2) A study of crops and their response to environmental and cultural influences.

(3) A study of crops, with a view to improving them to suit the varied environmental and soil conditions.

It is not my intention to go into detail with respect to the many researches and investigations at present under way in the Department of Field Husbandry, more than to say that the Alberta Crop Improvement Association is partly an outgrowth of the activities as carried out under number 3, mentioned above. This phase of our work having to do with plant breeding and improvement of all farm crops of economic importance is naturally a very heavy one. It was inaugurated in the summer of 1918. The need for more and better suited wheats, barleys, peas, grasses, clovers, corn and sunflowers, was one of the impressive and insistent facts borne out by our preliminary researches in climate and topography in this province. Inasmuch, moreover, as no breeding work was under way at any of the experiment stations in the province, the need for the vigorous prosecution of a comprehensive plant breeding program seemed all the more urgent. This program has been added to from time to time since, as conditions warranted.

Figure I.

Plant Breeding Operations, University of Alberta. Source of new strains and hybrids as well as Elite Stock Seed.

By 1919 and 1920 our plant breeding gave promise of yielding some improved strains of the cereal grains, due to selection, and in the near future it was apparent that several new strains, or hybrids, of all crops resulting from selection and breeding, would be available. The question arose, as to how best these products could be gotten out to the constituency, and thus ascertain their worth for the varied conditions we were trying to serve.

Another condition arose which claimed our attention and most earnest consideration. I refer to the call for assistance which was coming from growers of registered seed. At this time, it is true, there were only a few members of the Canadian Seed Growers' Association scattered over the province of Alberta.

On account of varying circumstances there were many problems incident to the activities of the Association in Alberta. Some of these may be mentioned as follows: Crop and seed inspection, production of Elite stock seed in sufficient quantities, the limitations, indeed the impracticability of the average western farmer maintaining a hand-selected seed plot (as was required of all members at that time) because of the extensiveness of his operations in the production of grain, the difficulty of securing suitable varieties for all conditions of climate, soil, altitude, etc.; and the most obvious need for producing a large supply of registered seed so that all farmers might derive the greatest benefit from the selection and breeding work being conducted at the University.

In view of the needs and difficulties cited, and in an endeavour to bring as much assistance to the crop producers as possible, the Department of Field Husbandry of the University, after carefully reviewing the best known seed growing organizations in Europe and America took the initiative in 1919-20, in forming a provincial organization, known as the Alberta Crop Improvement Association. This Association has been operating very successfully and growing rapidly from the date of its inception up to the present time. It is essentially an association of farmers interested in better crops and registered seed. Although it offers assistance to all farmers in the province, its membership does not include all farmers, since the association was designed to function in two ways, viz., first co-operatively with the Department of Field Husbandry in making local tests and multiplying new strains produced by selection and breeding, and secondly by the multiplication and ultimate distribution of high grade seed of approved varieties and strains in commercial quantities. The latter of these harmonizes well with the aims of the regular Canadian seed grower.

The Alberta Crop Improvement Association imposes no fees for membership. It is informal and non-commercial, and only tests of crops for their suitability, and registered seed growing are undertaken. Experimental tests in cultural methods have not been encouraged owing to the fact that sufficient supervision to make these of value could not be provided. It will be seen that the activities of this association constitute the field work of the Department of Field Husbandry, and stretch out to the uttermost parts of the province.

I shall not take time to tell you of the rules and regulations governing this association, more than to point to two or three of the outstanding conditions under which membership is given, as follows:—

1. All seed is sold at a cash price, whether for small tests or for the production of registered seed in large quantities.
2. Sufficient Elite seed under Section 2 is supplied to enable the grower to get into the production of commercial quantities of seed in a minimum of time. This ensures high purity and quality of the ultimate product.
3. Membership is retained by giving formal reports of crop tests carried out under Section 1 and paying cash for all seed.

During the first four years (1919-1923) of the Association's operations most gratifying results have been secured. They serve to point to the great need for such work as well as the future possibilities. Some three thousand crop tests have been conducted by farmers in the province, in crops and seeds sent out from the University. As old varieties are purified, or new strains are isolated, or hybrids developed, they are offered to

these co-operators under Section I of the Association. These tests extend from Fort Vermilion in the North, to Sweet Grass in the South, and indicate the suitability of such products for the great multiplicity of conditions under which they are grown. The chief crops and varieties to be tested to date are: Sweet Clover: Arctic Sweet Clover, Common Biennial Sweet Clover; Alfalfa: Grimm; Red Clover; Altaswede Clover; Grasses: Western Wheat Grass; Wheat: Marquis, Ruby, No. 111; Oats: Banner, Victory, Golden Rain; Barley: O.A.C. 21, Alberta Beardless, Smooth Bearded; Peas: White Albertan, Alberly Blue; Corn: Howes Alberta Flint.

The value of these tests cannot be overestimated. They indicate the suitability of a given crop for local conditions, which information is valuable to the farmer and experiment station alike. Without such information the plant breeder or instructor in crops works as it were blindly. Should it be a new crop, or new variety of crop to the district, everyone is interested in seeing how it will succeed, and accordingly the whole district benefits. It inculcates a desire, moreover, in the farmer for a wider range of crops, particularly if such as sweet clover, alfalfa, or red or alsike clover tests prove promising for that particular crop. This interest may even be broadened to other plants for beautifying the home by trying shrubs, trees, flowers of various kinds. The district is therefore, aroused to examine its very fullest crop possibilities which may even prove quite beyond the most sanguine expectations of the farmers themselves. Many farmers have, according to their own statements, been led to make cultural tests on quite a large scale when close observations are made in order to interpret results correctly. This has led to the discovery of some very important facts that have come to affect general farm practice to no inconsiderable extent. The general information which is conveyed back to this department by formal

Figure II.
Elite Seed being grown for distribution, University of Alberta.

reports is of the greatest value in teaching work and constitutes a very valuable source of material in answering questions in crop production.

Again farmers in many instances use seed resulting from their tests for future production of this or that particular variety of crop, which by test has shown a suitability. Altaswede Red Clover, Western Wheat Grass, White Albertan Peas, Sweet Clover, and some of the common cereals have in many instances been established in this way.

The educational value accruing from this kind of experimental work is also of some value.

Under Section 2 the Association's activities have been even more extensive. Starting modestly in the winter of 1919-20, with some six seed-growing centres in the eastern and central parts of the province, with some 28 farmers growing seed, the membership has increased to between three and four hundred, all of whom are growing registered seed. Some forty-five seed centres, located in all sections of the province, are now arranged for.

Elite stock seed was in such demand during the winter of 1922-1923 that it was found impossible to serve all. However, with so much first and second generation seed available from growers procuring seed in former years, no one need go without excellent stock seed.

The chief varieties to be distributed for registered seed production were Marquis, Banner and Victory. Other crops to be sent out though not eligible for registration, were Altaswede Clover, Howes Alberta Flint Corn, White Albertan Peas, together with some newer strains of cereals not yet named.

It is not possible to estimate accurately the amount of registered, registrable, and good commercial seed not eligible for registration, though tracing back to elite stock, that has resulted from the Elite seed thus far distributed. Close calculation was kept on these amounts until the figures reached a half million bushels. It is probable that the total will have reached several millions by this date. It is a common occurrence to receive letters from farmers whose whole farm is seeded to "thorough-bred" seed. It is fair to state that large sections of the province are using nothing but seed which traces back to elite seed. In numberless instances registration is not being sought, the desire being merely to have pure, uniform seed and crops, from properly selected seed of standard and other approved varieties. The Association's aims are well expressed in its motto, which reads as follows: "Pure Seed from Registered Stock, of suitable varieties and strains, available to every farmer in the Province of Alberta". This has by no means been achieved, but it is believed that only by the aid of such an organization as the Alberta Crop Improvement Association can such a happy state of affairs be even approximated in a province such as Alberta.

Some very interesting developments have grown out of the work of the members interested in registered seed production. In as much as the Alberta Crop Improvement Association did not lay plans at the outset to market elite seed produced by its members, it nevertheless recognized that this phase of production would soon require definite attention, and perhaps further organization of some kind. Hence, in order that the superior quality of this registered seed may be effectively brought to the attention of the public, including the American and Canadian seed houses, encouragement and assistance was given by the Department of Field Husbandry in 1920 and 1921, in which assistance has since been given by the Provincial Department of Agriculture, in assembling and placing entries from their seed crops at the International Grain and Hay Show at Chicago. All those who desired were carefully advised as to the suitability of their seed for showing at Chicago, and also as to the proper method of preparation for competition.

Very conspicuous success has attended the efforts of many members who competed at Chicago. These successes have attracted the attention, not only of Alberta farmers in general toward the members of the Alberta Crop Improvement Association, but also of leading agricultural men in every province and state of North America to recognize the

excellence of the registered seed which is being produced in this province. Such successes have also emphasized generally the fact of Alberta's capabilities of producing seed of the very highest quality. This effort and success by the growers at Chicago has paved the way for the marketing program which, during the last fourteen to sixteen months, has been evolved by the Provincial Department of Agriculture in conjunction with the growers.

Another undertaking, with the same purpose in view, is the placing of an educational exhibit in the 1923 International Grain and Hay Show. This exhibit combined to illustrate the methods followed in Alberta in producing and marketing registered seeds, the aim being, more particularly, to show how that by organized effort the Government, through the Provincial Department of Agriculture and the University, registered seeds are produced and marketed according to definite rules and regulations in the best interests of the producer, seed production, and agriculture as a whole.

It should be pointed out in closing that only through the moral and financial support and co-operation of the Provincial Department of Agriculture could the operations of the Alberta Crop Improvement Association be carried to a successful conclusion. Again, due to the effective and continued co-operation of the Dominion Department of Agriculture, in encouraging the production and use of good seed, has the work—particularly in Southern Alberta—been manifestly helped. During the last twelve months production of registered seed has been materially assisted, moreover, by an arrangement with the Dominion Government whereby the responsibility for inspection of standing crops, and threshed seed in sack, is placed under the supervision of the Seed Branch at Calgary. This will improve conditions very substantially and make for a higher standard of work.

Figure III.
Registrable Marquis Wheat. Grown in Alberta.

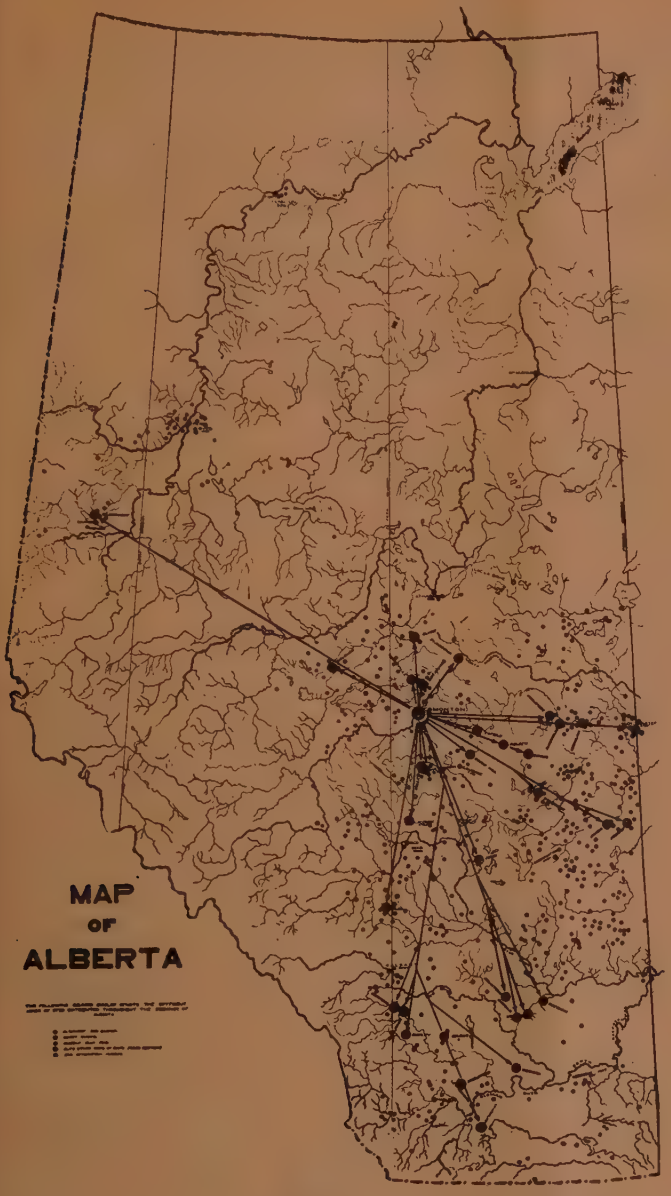

Figure IV.

Small dots indicate tests under Section I; large dots, Seed Growing Centres under Section II.

The Alberta Crop Improvement Association is yet but started on the tremendous task it is hoping to perform. If it can assist the plant breeding operations at the University in accomplishing for Alberta what the Swedish Seed Association has effected for the Svalöf plant breeders and Swedish people, that example will be well worth emulating. What Sweden's efforts in plant breeding have effected for her people in the production of seed from superior strains in Europe, and to some extent in America, might, with much hope of accomplishment, be expected by Alberta seed growers. With an admirable climate in a northern latitude there seems good reason to expect that Alberta, by a suitable program of plant breeding and seed production, can be made to provide America's seed supply of cereals, alfalfa—to some extent grasses—and as well quite a share of Europe's red clover seed.

Aside from these considerations it is a fact that Alberta must equip herself to meet keener competition on the markets of the world in raw and finished agricultural products. While it is true her cheap lands will give Alberta an almost incalculable advantage toward successfully meeting world competition, only, however, by the adoption of the most efficient methods of production can this be effectively met. The use of suitable crops and adapted varieties for existing conditions, together with high quality pure seed will ensure maximum yields and superior quality, both of which will help measurably to cheapen production and insure a margin of profit, thus contributing toward the end of meeting Alberta's competition on fair grounds.

Crédits Agricoles.

PAR V. N. VALGREN

La législation en matière de crédit agricole

L'Agricultural Credits Act de 1923, devenu une loi le 4 mars, complète un programme législatif que l'on a tenu en considération plus ou moins directement pendant une période de plus de 10 ans. En 1913, deux Commissions, dont l'une fut l'*American Commission*, assemblée sous les auspices du Congrès commercial du sud, et dont l'autre fut l'*United States Commission*, nommée par le Président en vertu d'une autorisation du Congrès, firent ensemble une étude des systèmes de crédit agricole en vigueur en Europe. Dans leur rapport, ces commissions recommandaient l'établissement d'une législation destinée à fournir aux agriculteurs américains des facilités en matière de crédit personnel plus en rapport avec leurs nécessités, et de même en matière de crédit hypothécaire pour satisfaire, d'une manière appropriée, à leurs besoins particuliers. Ces Commissions déclarèrent spécifiquement que les Banques existant aux États-Unis étaient adaptées aux besoins du commerce et de l'industrie plus qu'à ceux des agriculteurs, étant donné qu'elles emploient leurs capitaux pour des périodes relativement longues.

Les facilités fournies en matière de crédit hypothécaire par le *Federal Farm Loan Act*, devenu une loi en 1916, sont imputables dans une mesure importante à ces recommandations, et elles ont matériellement amélioré la situation en égard à l'hypothèque agricole ou crédit garanti par la propriété. Cependant, on remit jusqu'après l'année en cours les mesures définitives et permanentes à prendre en faveur du crédit personnel à consentir aux agriculteurs, et l'on aurait pu les remettre encore à plus tard si les besoins de crédit des agriculteurs n'avaient été accentués par la baisse récente des prix des produits agricoles d'où était résultée pour les agriculteurs une situation financière critique. Le besoin de crédit pour la vente fut aussi fortement accentué par le développement rapide des associations coopératives de vente des produits agricoles, qui, dans une certaine mesure, a été servi, depuis 1921, par l'organisation temporaire connue sous le nom de *War Finance Corporation*. Comme il est dit dans un article, dû à l'auteur de la présente étude, et qui a paru dans le *Bulletin des Institutions Économiques et Sociales* de novembre 1922, cette corporation a été grandement transformée en août 1921. Elle avait d'abord pour but de consentir des crédits aux industries de guerre et de promouvoir le commerce d'exportation. Ensuite, elle devint une institution de crédit rural temporaire, ayant spécialement pour object de satisfaire aux besoins que les agriculteurs ont de crédit, qualifié récemment d'intermédiaire.

Sous le régime du nouveau *Credits Act*, une banque fédérale de crédit intermédiaire est établie dans chacun des 12 districts de banque foncière fédérale en lesquels furent divisés les États-Unis sous le régime de la loi de 1916. Ces nouvelles banques doivent être placées dans les villes mêmes où sont situées les banques foncières fédérales, et les fonctionnaires et directeurs de ces dernières deviennent *ex officio* fonctionnaires et directeurs des nouvelles banques. Chaque banque fédérale de crédit intermédiaire a virtuellement un capital d'un montant maximum de $5,000,000 et qui doit être souscrit par le Trésor fédéral lorsque la direction de la Banque fait son appel de fonds. Afin de se procurer d'autres fonds susceptibles d'être prêtés, on peut créer des obligations de garantie collatérale, exemptes d'impôt, jusqu'à concurrence de dix fois de montant du capital versé et des excédents de la banque. Le montant net des bénéfices de chaque banque est versé, moitié aux États-Unis, et moitié à l'excédent de la banque, jusqu'à ce que cet excédent égale 100% du capital souscrit, après quoi 10% des bénéfices sont ajoutés à l'excédent, et le reste est payé aux États-Unis à titre de redevance pour privilège.

Ces banques ont pour but de fournir des facilités d'escompte aux banques et aux autres institutions financières ainsi qu'aux associations coopératives d'agriculteurs qui ont consenti des prêts pour des buts agricoles, pour des périodes de pas moins de 6 mois

ni de plus de trois ans. Des avances peuvent aussi être faites directement à des associations coopératives de producteurs agricoles pourvu que ces avances soient garanties par des récépissés de magasins généraux délivrés contre dépôt de produits agricoles marchands, ou par des hypothèques inscrites sur le bétail. Ni prêts ni avances ne sont consentis directement aux agriculteurs individuellement, car cela entraînerait un nouveau système bien aménagé d'agences financières qui augmenteraient d'une façon indue les dépenses à faire pour le crédit. L'intérêt qu'une banque fédérale de crédit intermédiaire exige sur les escomptes et les avances ne peut dépasser de plus de 1% l'intérêt payé sur les obligations emises, et le papier escompté ne doit pas entraîner à la charge de l'emprunteur isolé plus de 1½% d'intérêt au-dessus de celui de l'escompte. La partie de la nouvelle loi qui s'applique aux banques de crédit intermédiaire et qui est désignée par le Titre I, est sous forme d'amendement au *Federal Farm Loan Act* de 1916.

Un autre titre de la nouvelle loi autorise, sous la charte fédérale, l'organisation de corporations agricoles nationales de crédit, qui peuvent faire des prêts et des escomptes pour des buts agricoles comprenant l'élevage et l'engrais du bétail. Ces corporations, qui peuvent traiter avec les agriculteurs isolés comme avec les institutions de crédit, seront fournies de capitaux par des particuliers et administrées de même, et elles feront leurs opérations sous la surveillance du contrôleur de la circulation, qui surveille déjà les banques nationales dont il y a plus de 8.000 aux États-Unis. Les corporations agricoles nationales de crédit sont, comme les banques fédérales de crédit intermédiaire, autorisées à émettre des obligations de garantie collatérale jusqu'à concurrence de 10 fois leur capital versé et leur excédent, mais ces obligations ne jouissent pas du privilège de l'exemption de l'impôt. Aucune corporation de cette n'a jusqu'ici été d'une charte de constitution privilégiée, et il semble probable que c'est seulement sur le territoire ouest du Mississippi, où l'on demande un montant considérable de prêts pour le bétail, que les corporations de cette sorte trouveront un champ profitable. Les compagnies de prêt pour le bétail, qui existent actuellement et qui font leurs opérations sous le régime des lois de l'Etat, peuvent être réincorporés sous le régime des lois de l'État, peuvent être réincorporés sous le régime de la nouvelle réglementation législative fédérale.

Le pouvoir que possèdent ces nouvelles institutions de crédit de convertir le papier du crédit agricole intermédiaire en garanties rendues typiques par l'émission sous le contrôle du Gouvernement, d'obligations de garantie collatérale basée sur l'escompte ou l'achat du papier agricole ou sur les garanties du Gouvernement, achetées par ces institutions, serait démontré comme particulièrement avantageux pour les régions agricoles relativement éloignées des centres où il y a une disponibilité de fonds pour les prêts. Cela procurera un nouveau contact et meilleur entre les emprunteurs et ceux qui ont des fonds à placer. A cause de la sûreté et de la convenance qu'il offre aux capitalistes, il placera l'agriculture dans une situation semblable à celle des autres industries, en ce qui concerne la concurrence dans la recherche des capitaux, et ainsi il réduira les frais que l'agriculteur doit supporter pour obtenir du crédit personnel et du crédit collatéral.

La nouvelle loi pourvoit aussi à l'établissement de ce qu'on appelle l'organisation permanente des 12 banques foncières fédérales. Ces banques, dont le capital initial a aussi été avancé par le Gouvernement fédéral, furent placées sous des directions temporaires nommées par le *Federal Farm Loan Board* pour tout le temps que, par leur souscription aux actions de la banque par l'intermédiaire de leurs associations locales, les emprunteurs y auraient un intérêt financier raisonnable, après quoi, six des neuf directeurs seraient élus par les emprunteurs et par les porteurs d'actions. Pour des raisons exposées dans l'article de novembre 1922 mentionné plus haut, cette organisation temporaire fut conservé en vigueur jusqu'au passage de la nouvelle loi sur le crédit. Sous de régime des mesures de la loi qui ont été l'objet d'un amendement, chaque banque foncière fédérale, en même temps la banque de crédit intermédiaire qui lui est associée, est administrée par un conseil de sept directeurs, dont trois sont élus par les porteurs d'actions, et trois sont nommés par le *Federal Farm Loan Board*. Un septième directeur est choisi par le *Board* entre les trois personnes pour

lesquelles auraient voté a cette occasion le plus grand nombre de porteurs d'actions de la banque. La participation à d'administration du système du prêt agricole est jusqu'ici limitée aux personnes qui ont obtenu des prêts à long terme dans les banques foncières fédérales et qui ont donné comme garantie une première hypothèque sur leurs exploitations, tandis que les institutions financières ou les associations coopératives qui patronnent les banques de crédit intermédiaire n'ont pas voix à l'administration dans le système fédéral du prêt agricole. La nouvelle législation apporte encore un amendment au *Federal Farm Loan Act* tel qu'il était au début, en augmentant le montant qui peut être emprunté par un agriculteur isolé, et en le portant de $10.000 à $25.000. Cet amendement fut particulièrement dicté par les besoins des agriculteurs de la partie supérieure de la vallée du Mississippi, où les exploitations sont relativement grandes, malgré la valeur élevée de la terre, et où, dans la plupart des cas, un prêt de $10.000 était tout à fait insuffisant pour couvrir les besoins de quiconque aurait eu l'intention d'acheter une exploitation de grandeur moyenne.

Le *Federal Reserve Act*, qui devint loi formelle en 1913, et qui établit 12 banques de réserve pour desservir, respectivement, les 12 districts de réserve fédérale en lesquels sont divisés les États-Unis, est l'objet d'un amendement rendant plus libérale le définition du papier tiré pour un "but agricole". Ce but est maintenant envisagé de manière à contenir la classification et le traitement des produits agricoles par les associations coopératives de vente. En outre, le terme de l'escompte d'un papier tiré pour un but agricole, qui dans le texte original de la loi était de six mois, en regard des trois mois qui sont la limite du papier commercial, est porté à neuf mois par la nouvelle loi, ce qui ouvre le système de la réserve fédérale au point d'en faire quelque chose venant s'ajouter au papier agricole du crédit intermédiaire.

Tandis que l'on demande aux banques nationales d'être des membres de la banque de la réserve fédérale de leur district respectif, les banques d'État ont le choix, elles peuvent se joindre à ce système ou rester en dehors. Actuellement, sur un nombre approximatif de 22.000 banques faisant leurs opérations sous le régime des lois d'État, environ 1600 seulement sont membres de la banque de la réserve fédérale de leur district. Afin d'encourager les banques d'État à devenir plus généralement des membres du système de la réserve fédérale, et à faire profiter davantage de leurs facilités d'escompte les districts agricoles, on réduit temporairement le montant du capital exigé de celles de ces banques qui désirent s'unir à ce système. Une banque d'État peut maintenant y être admise si son capital est à 60% de celui est requis d'une banque nationale, pourvu que, dans un délai raisonnable, cette banque d'État consente à augmenter son capital jusqu'à concurrence du montant requis d'une banque nationale ayant une situation semblable quant à la grandeur de la ville où elle est située.

La période d'activité de la *War Finance Corporation* a été étundue jusqu'au 29 février 1924, car les institutions de crédit créées ou autorisées peuvent bien être établies avant que l'aide de cette corporation soit supprimée. Enfin, la loi pourvoit à formation d'un comité commun des deux chambres du congrès en vue d'une enquête sur le problème consistant à encourager les banques d'État à s'autoriser plus généralement de cette qualité de membres dans le système de la réserve féderale.

Les douze banques fédérales de crédit intermédiaire ont été organisées avec une rapidité recommandable après que la nouvelle loi eut été votée. Chaque banque fit immédiatement appel d'un million de dollars de capital, et à l'époque de la souscription, c'est-à-dire au 15 août, cinq de ces banques ont fait appel de capital supplémentaire pour un montant total de $5.000.000, ce qui porte le capital actuellement versé des 12 banques à $17.000.000.

Il a été fait pour un montant de $1.000.000 d'escomptes de papier agricole bancable, et environ $5.000.000 ont été avancés aux associations coopératives agricoles s'occupant de coton, de blé, de laine, de tabac et de fruits en conserves. En prévision de demandes plus nombreuses d'escomptes et d'avance, à mesure qu'on avançait vers la récolte et vers la saison de la vente, on a

vendu pour $10.000.000 d'obligations émises. Ces obligations sont émises pour un terme de six mois au taux de 4½% par an.

Pour le présent, tous les escomptes et avances des banques fédérales de crédit intermédiaire sont limités par ordre du *Federal Farm Loan Board* à un terme maximum de neuf mois, mais pratiquement on donne l'assurance que ce terme sera étendu par des renouvellements lorsque ce sera nécessaire et qu'il y aura des garanties. A ce propos, on peut dire qu'il y a pour l'emprunteur beaucoup moins de danger à compter sur les renouvellements de l'une de ces banques de crédit intermédiaire, que lorsqu'il s'agit d'une banque commerciale de dépôt, car les fonds de cette dernière sont plus exposés à diminuer tout à coup en cas de disette financière.

En conclusion, on peut dire que le service réel des banques fédérales de crédit intermédiaire comme celui de la *War Finance Corporation* qui, nous l'avons indiqué plus haut, est encore en activité, ne peut être mesuré d'après la masse des escomptes ou avances qu'elles font. Les institutions de crédit rural et particulièrement les associations coopératives agricoles peuvent avoir du crédit en puisant à cette source, et cela amène souvent on encourage les capitalistes isolés et les agences de crédit à couvrir les besoins du crédit local, quand, en l'absence de cette source de crédit ils pourraient bien s'écarter de ce genre d'opérations. Nombre d'associations coopératives de vente ont, au cours de ces deux dernières années, reçu les offres de crédit des particuliers pour un montant important et à des conditions avantageuses, mais seulement après que la *War Finance Corporation* leur avait promis des avances. Le résultat en est qu'une grande proportion des avances promises ou approuvées par cette corporation n'ont plus jamais été demandées par les associations.

Étant donné les diverses mesures que porte l'*Agricultural Credits Act* de 1923, qui sont: l'établissement de banques de crédit intermédiaire recevant leurs capitaux du Trésor fédéral, l'autorisation de corporations de crédit agricole à charte fédérale mais recevant leurs capitaux des particuliers, puis la nouvelle adaptation du système de la réserve fédérale aux besoins de credit particuliers aux agriculteurs, on peut espérer que la seconde moitié du problème du crédit rural tel qu'il avait été posé dans le rapport des commissions américaines et des États en 1913, a été pratiquement résolue, dans la mesure où la législation fédérale pouvait y apporter une solution. Quand ce nouveau mécanisme sera en pleine activité, l'agriculteur américain se trouvera au fond de pair à égal avec le commerce et l'industrie, en ce que crédit sera à sa disposition même s'il est éloigné des centres où il y a du capital à emprunter, et cela à un prix que justifient sa situation et la forme de garantie qu'il peut donner, et pour une durée qu'exigent les bénéfices de son affaire, qui sont relativement faibles.

A NOS MEMBRES FRANCAIS.

Je regrette infiniment que mes travaux d'organisation pour le recrutement des membres et des annonceurs coincidant avec le surcroit d'ouvrage qui m'a acceuilli à mon retour d'Europe m'empêche de préparer un rapport sur mon tour de France et de Belgique, et l'article de la rédaction française.

GEORGES BOUCHARD.

Concerning the C.S.T.A.

AGRICULTURAL INSTRUCTION ACT

At the time of writing it is impossible to make any definite statement as to the action of the Federal Government in the matter of further financial support to the provinces for purposes of agricultural education. The agricultural estimates will not be considered until early in February.

On January 3rd, 1924, representatives of the Provincial Departments of Agriculture and of the Canadian Society of Technical Agriculturists, met the Cabinet and submitted their arguments in support of a renewal of the Federal grant. Those on the delegation were: Premier Greenfield of Alberta who introduced the delegation and spoke for Alberta and British Columbia; Hon. C. M. Hamilton, Minister of Agriculture for Saskatchewan, who also represented Manitoba; Mr. W. B. Roadhouse, Deputy Minister of Agriculture for Ontario; J. A. Grenier, Deputy Minister of Agriculture for Quebec; Hon. D .E. Mersereau, Minister of Agriculture for New Brunswick, who represented the Maritime Provinces; Prof. H. Barton and F. H. Grindley, President and General Secretary, respectively, of the C.S.T.A. About eight members of the Cabinet were present.

This delegation presented its case in about one hour, and Premier King replied for the Cabinet in about five minutes. He admitted that all the arguments presented were sound and had been carefully considered by the Government when the grant was under consideration a year ago. He then emphasized the financial condition of the government and the heavy burden it was carrying as a result of the war, and expressed the opinion that the Provinces should now assume some of the expenses which the Dominion had been paying during the past, including the Federal grant for Agricultural Education. His main arguments against a renewal of the grant were as follows:

(1) The need for economy on the part of the Dominion Government.
(2) The Federal Grant had been introduced in 1913 at a time when the Government had plenty of money.
(3) It was never intended that the grant should be renewed after the expiration of the ten year period, but as no statement to this effect had been made by the late Government, it had been renewed last year and fair warning was given to the provinces at that time.

The meeting then adjourned. Of the three arguments presented by the Prime Minister, the first two were obviously sound but the third was open to considerable rebuttal. In 1913 when the Hon. Martin Burrell (then Minister of Agriculture) introduced the Agricultural Instruction Act into the House of Commons he stated that after ten years the Government would probably find it advisable to increase the grant. There was no mention of discontinuance. For that reason, it was not the duty of the late Government to warn the provinces. In any case, the late Government did not function after December 1921, whereas the ten year period did not expire until March 31, 1923.

In spite of the discouraging tone of the meeting on January 3rd, the C.S.T.A. has continued its efforts for a renewal of the grant and it is to be presumed that the provinces have been equally active. There is no reason to suppose that the grant will be discontinued or reduced. Nothing is known.

In order that members of the Society may know what arguments were submitted by their representatives, the statement of Professor Barton, who spoke for the C.S.T.A., now follows:—

Statement of Prof. H. Barton

On behalf of the Canadian Society of Technical Agriculturists I have the honor to present the following resolution, copy of which

was officially mailed to you and which was unanimously supported by the members of the Society, assembled in Annual Convention at Saskatoon in June 1923.

> "THAT WHEREAS, the ten year period during which federal assistance to the Provinces was granted in support of agricultural education in accordance with the terms of the Agricultural Instruction Act of 1913 ended on the 31st of March last, and WHEREAS federal assistance for the purposes already defined in the said Act has been continued on a somewhat reduced scale and for the present fiscal year only, and WHEREAS, the assurance of continued assistance from the Dominion Government in support of Agricultural instruction is essential to the establishing of considered and permanent methods of development along this line, and WHEREAS it is generally believed that any withdrawal of federal support in this direction will inevitably result in the total or partial abandonment of many lines of work of great benefit to the Provinces as well as to Canada as a whole, THEREFORE BE IT RESOLVED that the Dominion Government be urgently requested at its next session to enact such legislation as will ensure to the Provinces continued and generous support towards the furtherance of agricultural instruction."

The Canadian Society of Technical Agriculturists has a membership of seven hundred, including all the prominent men in Professional Agriculture in Canada and a number of leading men engaged in farm practice; it has local branches in all the Provinces; its chief object is the promotion of a better Agriculture and through its members it has personal contact with all Agricultural organizations and farmers throughout the Dominion.

As representatives of this Society we are in a position to furnish first hand information on the workings of the Agricultural Instruction Act, and to appreciate its importance in assisting Agriculture. Since the Act was not renewed last year and since a substantial reduction was made in the grant we have been deeply concerned in regard to it; hence the above resolution in support of which at this time we invited your attention to the following considerations:—

1.—At no time in the history of agricultural education in Canada has a condition of stagnation appeared more threatening. Decreased attendance at all Agricultural Colleges, the closing of Agricultural Schools, and waning interest in general short courses bear witness to this fact.

The widespread depression in Agriculture has developed many obstacles to the effectual functioning of agricultural institutions and agencies. Through the Federal Grant extensive facilities and many workers in the cause of Agricultural education have been established throughout the country. From them a great deal is expected and while much has been accomplished, prevailing conditions have presented problems upon which education can have but an indirect effect and then only in the course of time, but which, nevertheless, seriously handicap the operations of Agricultural workers. So much so that these conditions are reacting unfavorably on the whole process of Agricultural education. All the more effort at this time therefore, is required on its behalf. Withdrawal of support will tend to accentuate the danger already apparent. Indeed it is not too much to say that at this time an impetus to Agricultural education is more urgent than it was when the Act was passed.

2.—Despite greatly increased expenditure on the part of provinces the money available from all sources is not sufficient to allow full and effective use of the machinery that has been built up. The Federal Grant has made it possible to develop extensive systems of Agricultural education, but proper functioning of some of them has been retarded by the war and the conditions following it. If these are not to become burdensome overhead a further impetus must be given to them in the near future. Others have become established services of a type that must be progressive if they are to perform their greatest usefulness. Any policy that indicates drastic retrenchment must tend to prevent their full development and discourage initiative in new fields of work however pressing they may be.

3.—The Federal Grant has served as an incentive to cooperation in agricultural effort, and it has been instrumental in promoting a measure of coordination in the work. There is need for much more development in this direction and federal assistance in provincial agencies in a field so complex as is Agriculture, is sufficient in itself to justify the continuation of the grant.

4.—A great deal of the work on behalf of Agriculture in Canada thus far naturally has been of an elementary character. The time has come in Agriculture as it has in other industries when deeper and more difficult problems must be dealt with. Research of a high order is therefore imperative. In the various provinces, facilities, a number of which have been provided through the Federal assistance, are available and men with advanced training are becoming numerous. Money is all that is required to put them to work on problems which, while they may be centred in provinces are of national importance. Canada is wonderfully equipped with Agricultural institutions, institutions that are staffed with highly trained men but institutions that, one and all, are starving for financial assistance to do research work. Research work for the country as a whole cannot be confined to one department or one laboratory, nor can teaching institutions live without it. Research work was not specified in the Act providing the Grant, but institutions are now ready for it; problems of all kinds are pressing for solution and men must be trained to deal with them.

The following is taken from the report of a committee of the society appointed to study the question of research in Agriculture in Canada.—

"Your committee would urge upon the society and through it upon the Canadian public the national importance of Agricultural research and the economic value of additional expenditure in that direction.

We believe all stockmen will agree that a crying need of the country is for additional research, as well as additional instruction in Veterinary medicine. There can be no question that there is an enormous loss of national wealth caused by preventable and curable diseases and that the economies that could be realized by increasing the personnel of the Veterinary profession, raising the standards of instruction and especially rendering possible the adequate training in research of the staffs of the Colleges and providing facilities for research in the Colleges, as well as in the Federal Department of Agriculture, would yield a handsome return upon the investment involved."

5.—The Dominion Department of Agriculture requires highly trained men in increasing numbers. It looks to provincial institutions to supply them and is insisting upon a higher standard of equipment. Such men cannot be developed with the present financial conditions of these institutions. Under these circumstances it would seem only fair therefore that the Dominion Government should assume some obligation in the necessary provision for equipping the men it requires for so extensive a feature of its activities.

6.—The prevailing feeling of uncertainty in regard to the Federal Grant is very disturbing to those who are employed under it, also to those who are responsible for appointments and have to do with the planning and supervision of the work it makes possible. This condition is militating against the best use of the money being spent at the present time.

7.—In 1914—one year after the Agricultural Instruction Act was passed in Canada, the United States passed the Cooperative Extension Act whereby the Federal Treasury supplied money in increasing amounts to each State until 1922 when and after such time the total amount for the country would be $4,580,000.00, the States to supply equivalent amounts, and all to be devoted to extension work, one of the chief purposes of the Canadian fund.

The Secretary of the U. S. Department of Agriculture in his report for the year 1915 in his reference to this Act stated:

"The Cooperative Extension Act of May 8th, 1914 provides for a nation-wide sys-

tem of instruction for the farming population in Agriculture and home economics outside of the schools and colleges. It establishes a close co-partnership between the Federal and State agencies in the organization and administration of the extension service. The department is under obligation not only to contribute to the formulation of plans of work which are to be eventually agreed upon, but also to assist the colleges in executing them in the most efficient manner. The law contemplates a unified extension organization in each state which will represent and be responsible to both the college and the department."

Substantial reductions in Government expenditure and in Taxation are reported from Washington but there is no intimation that Federal assistance to the State institutions and agencies is to be curtailed. In Canada the need for such assistance is greater that it is in the United States. With farming in its present grave condition, with young Canadians actually fleeing from the farms and in the midst of a strenuous effort on the part of the Government to replace them with immigrants who are unfamiliar with Canadian farm practice, the time appears most inopportune for withdrawing the assistance from Agriculture that it so urgently needs.

NOTES

E. T. Chesley (O.A.C. 1921) has been appointed Assistant Editor, Division of Extension and Publicity, Experimental Farm, Ottawa. He was formerly Associate Agricultural Editor of the Toronto "Globe."

Gordon Whiteside (O.A.C. '22) will take up his new duties as Cerealist at the Central Experimental Farm in February.

The Eastern Ontario Branch will hold an informal dance at Ottawa, Feb. 15. This will be the first occasion on which this branch has departed from its custom of holding meetings of a more or less serious nature. A series of regular monthly meetings will be resumed at the University Club, Ottawa, in March.

The S. Saskatchewan branch held meetings at Regina in November and December. A meeting was held at Moose Jaw on January 23rd, to discuss the Agricultural grant situation. Hon. C. M. Hamilton, Provincial Minister of Agriculture, was present.

The Montreal Branch is holding an informal luncheon at Laval University Club on February 2nd, at which Prof. H. Barton, President of the Society, will be the guest of honour.

FRENCH SECRETARY APPOINTED

Georges Bouchard, Professor of Botany at Ste. Anne de la Pocatiere, P.Q., has been appointed French Secretary of the C.S.T.A. This appointment was approved by the Dominion Executive Committee at Saskatoon in June, 1923, but on account of his absence in France, Prof. Bouchard was unable to commence his duties until January 1st.

In co-operation with the General Secretary, Prof. Bouchard will assist in increasing the membership of the Society in Quebec province, will edit the French section of the magazine, solicit advertising and subscriptions, etc. It is anticipated that his appointment will do much to give the Society a new impetus among the French sections of Quebec.

THE C.S.T.A. WHO'S WHO

As predicted last month, preliminary biographies have now been mailed to all English-speaking members of the Society, with the exception of a few who have failed to return the original questionnaire. The preparation of French biographies will be commenced immediately and it is probable that the volume will be ready for printing on March 1st. In order that there may be some unanimity of opinion as to the proper arrangement and classification, as well as of other details, a small local committee will hold several meetings at Ottawa during the last two weeks of February.

As the C.S.T.A. "Who's Who" will contain at least 700 biographies, it may be considered to be fairly representative of professional workers in agriculture in Canada, and judging from the number of advance orders already received, not only from members but from individuals and institutions outside of Canada, it has long been needed.

1924 CONVENTION

The Fourth Annual Convention of the C.S.T.A. will be held at the Ontario Agricultural College, Guelph, June 10th to 12th inclusive, 1924. As this Convention is being made a part of the O.A.C. Semi-Centennial celebrations, which extend from June 9th to 14th, there will be only three mornings available for C. S. T. A. business sessions; and two evenings for informal addresses, etc. During the balance of the week those attending the C.S.T.A. Convention will be able to participate in the Semi-centennial celebrations, complete details of which will probably be available for publication in the next issue of *Scientific Agriculture.*

GEORGES BOUCHARD
Appointed French Secretary of C.S.T.A.

APPLICATIONS FOR MEMBERSHIP

Since January 1st, the following applications for membership have been received:

Auger, André (Laval, 1920, B.A., B.S.A.) Le Ecureuils, P.Q.

Blair, A. (B. C. 1923, B.S.A.) R.R. 1, Steveston, B.C.

Caron, Omer (Laval, 1915, B.S.; 1920, B.S. A.) Dept. of Agriculture, Quebec, P.Q.

Charbonneau, R. P. (Syracuse, 1923, B.S.A. Ste. Anne de la Pocatiere, P.Q.

Dickson, F. (Queen's, 1920, B.A.) Universit of B.C., Vancouver, B.C.

Fisher, R. A. (B. C. 1922, B.S.A.) Dept. o Lands, Victoria, B.C.

Godwin, C. H., Lab. of Plant Pathology Fredericton, N.B. (Associate).

Grant, H. C. (Manitoba, 1922, B.S.A.) Agricultural College, Winnipeg, Man.

Jamieson, M. C. (Toronto, 1922, B.S.A. Dept. of Agriculture, Winnipeg, Man.

MacLeod, M.A., Sussex, N.B. (Associate).

Mutch, G. A. (Saskatchewan, 1920, B.S.A. Regina, Sask.

Parent, R. C. (Toronto, 1923, B.S.A.) Macdonald College, P.Q.

Pépin, Auguste (Laval, 1916, B.A. 1919, B. A. Cornell 1923, Ph.D.) Deschaillons, P.

Poisson, Emile (Laval, 1920, B.S.A.) Pierre les Becquets, P.Q.

Prodau, C. S. (Manitoba, 1921, B.S.A.) Ea Kildonan, Man.

Racicot, (McMaster, 1921, B.A.) Ste. An de la Pocatiere, P.Q.

Rioux, Chs. Eug. (Laval, 1921, B.S.A.) Tite, P.Q.

Rogers, J. T. (Saskatchewan, 1923, B.S.A Macdonald College, P.Q.

Sweeney, J. R. (Toronto, 1920, B.S.A.) De of Agriculture, Winnipeg, Man.